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Michael D. Akers

Marquette University, michael.akers@marquette.edu

Robert E. Jordan

University of Wisconsin - Superior

Grover L. Porter

University of Alabama - Huntsville

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An Examination Of Management Accountants' Use And Perception Of Expert Systems

Michael D. Akers, (E-mail: 6320akersm@vms.csd.mu.edu), Marquette University
Robert E. Jordan, (E-mail: bjordan@staff.uwsuper.edu), University of Wisconsin-Superior
Grover L. Porter, (E-mail: PorterG@email.uah.edu), University of Alabama-Huntsville

Abstract

Although there has been a number of articles written about the possible use of expert systems by management accountants, there has been limited research to support such predictions. The primary purposes of this paper are to examine management accountants' use and perceptions of expert systems. A survey instrument was designed to elicit responses (Likert scale and open-ended) about management accountants' perceptions of the current and future use of expert systems and to determine their knowledge, interest and involvement with such systems. The findings of this study indicate that although respondents are moderately interested and involved with expert systems, they have a limited knowledge of those systems. The respondents do agree that expert systems will be utilized more in the future, and that management accountants will be involved in the development and use of expert systems. Expert systems will be utilized to reduce inventories and improve productivity. The respondents, however, do not agree that expert systems are currently used for the management accounting applications used in this study. Also, their expectations regarding the current and future use of expert systems are significantly different. Expectations of the future use of expert system can be found in management accounting literature over the past fifteen years. The findings of this study indicate prior expectations have not materialized.

Introduction

During the past ten years there have been several bold predictions in the management accounting literature about the importance and use of expert systems by management accountants. For example in 1986, a group of authors stated that "it is vital that the management accountant understands expert systems and the functional applications of such technology in today's business environment

Readers with comments or questions are encouraged to contact the authors via e-mail.

(Akers et al. 1986). The authors' comment is consistent with a directive in *The Impact of Information Technology on the Accounting Profession* (International Federation of Accountants 1992) that management accountants have to become familiar with a much wider range of technologies and sophisticated decision tools. The *Objectives of Management Accounting* also states that the management accountant should be familiar with current technology (emphasis added). Brown and Phillips (1995) conducted a field study for the Institute of Management Account-

ants (IMA) on the use of expert systems for management accounting tasks and concluded:

Expert systems technology offers a valuable tool that management accountants can use to enhance their effectiveness and improve their efficiency. Expert system technology has been used successfully for management accounting tasks in a wide variety of industries and government agencies. As management accountants reengineer business processes, expert systems will continue to be used as a tool to improve performance (emphasis added).

The above comments indicate that management accountants should be familiar with expert systems and that expert systems have been and will continue to be a useful tool. Such comments are not supported by the limited empirical research which have the primarily been field studies that focused on specific companies. There are two primary purposes of this paper: (1) to determine management accountants' knowledge, interest, and involvement with expert systems and (2) to examine their perceptions of the current and future use of expert systems.

The subsequent sections of the paper are organized in the following manner: (1) the first section provides an overview of management accounting literature to identify potential and current uses of management accounting expert systems applications, (2) the design and results of the study are presented in the next section, and (3) concluding comments are provided in the final section.

Management Accounting Expert Systems Applications

Although there have been a number of articles written on the topic of Expert Systems, there has been little research into the actual use of these systems in the management accounting area. Brown and Phillips (1995) used site visits, telephone interviews and an extensive literature review to identify over 150 management expert

systems. Brown and Phillips extensive literature review showed that expert systems are being used for many different management accounting tasks. Those tasks include: inventory management systems, financing decisions, capital budgeting, transfer pricing, variance analysis, performance evaluation, incentives and compensation schemes, planning and budgeting, product pricing, information systems selection, training of management accountants, project scheduling, internal control evaluation, and stock level forecasting.

In addition to the Brown and Phillips study, there is one field study (Boer 1989) and one survey investigation (Sangster 1996). Boer studied two companies in depth and visited another company to develop an expert system to evaluate budget variances and to identify several potential management accounting expert systems applications. Sangster investigated management accountants' perceptions of the use of expert systems in the United Kingdom. Sangster surveyed 4,000 U. K. based professionally designated management accountants to determine the level of awareness and diffusion of expert systems technology. His findings show a low level of awareness and a very low level of diffusion (Sangster defines diffusion as the process of change).

Design and Results of the Study

Design

A survey instrument was designed to elicit responses (Likert scale and open-ended) about management accountants' perceptions of the current and future use of expert systems and to determine their knowledge, interest and involvement with such systems. The Institute of Management Accountants' Director of Research reviewed the instrument prior to mailing to IMA members. The instrument was mailed to a random sample of 500 plant controllers and/or systems analysts drawn from a population of 2,048 plant controllers and 388 system analysts who

are members of the Institute of Management Accountants. If prior predictions about the use of expert systems are correct, plant controllers and systems analysts should have an understanding of such systems. (Akers et al.1986).

Research Questions

The following research questions were developed in order to test several predictions from the management literature regarding the understanding and use of expert systems by management accountants. First, are management accountants knowledgeable of expert systems? Second, are management accountants interested in expert systems? Third, what proportion of management accountants are currently involved with expert systems? Fourth, what are management accountant's perceptions regarding the current use of expert systems for management accounting applications? Fifth, what are management accountant's perceptions regarding the future use of expert systems for management accounting applications? Sixth, are there differences in management accountant's perceptions regarding the current and future use of expert systems for management accounting applications?

Respondents

Ninety-nine usable survey instruments were returned for a response rate of 20 percent. Table 1 provides demographic information (age, certification, education, and work experience) on the survey respondents. The majority of respondents were over forty years of age with more than fifteen years of work experience. About one-half of the respondents held an accounting certification and the group was evenly split between those with Bachelor's degrees and those with Master's degrees.

Knowledge, Interest and Involvement

Table 2 presents the respondents' knowledge, interest and involvement in expert sys-

Table 1
Respondent Demographics

Age Group	
Under 30	6 %
31 - 40	30 %
41 - 50	46 %
51 - 60	15 %
Over 60	3 %
Certifications*	
CMA	32 %
CPA	26 %
Other	5 %
None	48 %
Education	
Bachelor's Degree	50 %
Master's Degree	50 %
Work Experience	
2 - 5 Years	3 %
6 - 10	18 %
11 - 15	10 %
Over 15	69 %

*Certifications percentages sum to more than 100% because 11% of respondents hold both CMA and CPA certificates

tems. The results of the study show the respondents' knowledge of expert systems is limited. Only 14 % of the respondents indicated significant knowledge in the expert systems area. Further support of this finding is that 10% of the respondents' comments indicated a lack of knowledge of expert systems as illustrated by the following: "I've never heard of Expert Systems", "I do not know what expert systems are", and "I had to call on IT Manager to be sure what an expert system is?".

These results are consistent with Sangster's (1996) findings. The Sangster findings demonstrated that management accountants in the United Kingdom are not familiar with expert systems. This study also finds that management accountants in the United States are not familiar with expert systems.

The respondents' interest in expert systems, although greater than their knowledge, is moderate at best. The majority (63%) of the respondents have limited to moderate interest in expert systems while only 13% have a significant interest. The findings also show that most (82%) of the respondents have limited to moderate involvement with expert systems. This result is not surprising considering the respondents' limited knowledge of and interest in expert sys-

tems. Table 3 presents the respondents' perceptions regarding the current use of expert systems for the following management accounting applications: education and training, information management, database development, inventory management and production management. Since the mean responses (1 = strongly disagree; 5 = strongly agree) ranged from 2.30 to 2.60, the findings indicate the respondents believe the current use of expert systems is limited for the management accounting applications listed above. The results are consistent with Sangster's (1996) findings that there has not been a significant diffusion of expert systems among U.K. management accountants.

Table 2
Respondents' Knowledge, Interest, and Involvement
in the Expert Systems Area

	Limited	-----	to	-----	Significant*
Knowledge	32%	27%	27%	8%	6%
Interest	13	16	34	24	13
Involvement	47	21	14	12	6

*Likert Scale (1 to 5)

tems.

These finding appear to be consistent with two of Sangster's conclusions: (1) diffusion of expert systems among management accountants is at an early stage and (2) it will be some time before expert systems are used significantly by management accountants.

Current Use of Expert Systems

The majority of the respondents (74%) indicated they are not currently using expert systems. Although 26% of the respondents indicated they are using expert systems, the description of current applications indicated other types of systems are being used rather than expert systems. The following comment illustrates this point: "Yes: Rule-based rate calculating are built in a purchased distribution management system to calculate commission (An integration package-Not real E.S)". This finding further illustrates the lack of understanding of expert systems and that the current use is less than the 26% reported.

To provide additional insights about the current use of expert systems, the perceptions of respondent-type classifications compared: (1) CMA's / non-CMA's; (2) CPA's / non CPA's; (3) bachelor's degree / master's degree; (4) experience \leq 15 years / experience $>$ 15 years; (5) limited knowledge of expert systems / significant knowledge of expert systems; (6) limited interest in expert systems / significant interest in expert systems; (7) limited involvement with expert systems / significant involvement with expert systems; (8) currently not using expert systems / currently using expert systems; (9) no future plans to use expert systems / future plans to use expert systems. There are no significant differences with respect to the current use of expert systems for three of the comparisons: education (bachelors/masters), experience (\leq 15 years / $>$ 15 years) and future plans (no / yes). An examination of the significant differences, for all comparisons, show three are most frequently cited: expert systems will (1) be used to minimize inventory on the factory floor; (2) enable factories to cut inventories; (3) be used to adjust production schedules to customer orders.

Table 3
Current Use of Expert Systems

Statements to Measure Perception of Current Use of Expert System Utilization	Likert Scale Average ¹
Expert systems are used to train and educate new management accountants by teaching the rules and reasoning that an expert in the field actually uses.	2.39
Management accountants are familiar with expert systems and how they can be used in the process, control, and use of information.	2.30
Management accountants are involved in the development of the database (knowledge and domain) of the expert system.	2.59
Expert systems are used to reduce production bottlenecks.	2.52
Expert systems are used to minimize the inventory on the factory floor.	2.60
Expert systems are used to change production schedules when production equipment breaks down.	2.46
Expert systems are used to change production schedules when materials are in limited supply.	2.52
Expert systems are used to adjust production schedules to customer orders.	2.55
Estimated percentage that expert systems currently enable factories to cut their inventories.	11.94 % ³
Estimated percentage that expert systems currently improve productivity.	10.09 % ³

¹Average of all responses on a 1 (Strongly Disagree) to 5 (Strongly Agree) Likert scale
²Percentage of respondents that selected 1 (Strongly Disagree) through 5 (Strongly Agree)
³Average respondent estimate given in response to an open-ended question

The results for CMA's and CPA's are interesting. There is only one significant difference exists between CMA's and non-CMA's. Non-CMA's perceive that expert systems are currently being used to a greater degree than CMA's to minimize inventory on the factory floor. CPA's, however, believe expert systems are currently used more so than non-CPA's for four inventory applications. Since expert systems have been more widely used for financial and auditing task, these findings are not surprising.

Future Use of Expert Systems

Table 4 presents the respondents' perceptions concerning the future use of expert systems for the same management accounting applications. The results indicate a greater, although moderate (responses ranged from 3.21 to 3.79) use of expert systems in the future.

Even though respondents had a more optimistic view of the future use of expert systems when compared to their perceptions of cur-

rent use, the majority of companies represented by the respondents (62%) have no future plans for expert system applications. Among those who indicated that their company would be using expert system applications in the future were some which did not understand the meaning of expert systems. In response to the question of future expert system applications one respondent replied, "Yes; A move beyond client server technology into object-linking with Internet functionality." In part, the optimism about the future of expert systems seems to be the expectation that advances in technological will foster greater efficiency and effectiveness.

To gain a better understanding of the perceptions of the future use of expert systems, the same eight comparisons were examined. Consistent with the current use results there are significant differences for knowledge, interest, and involvement, and there are no significant differences for education and experience. The one significant difference between CMA's and non-CMA's, once again, focuses on inventories. While significance differences were also ex-

Table 4
Future Use of Expert Systems

Statements to Measure Perception of Future Expert System Utilization	Likert Scale Average ¹
Expert systems will be used to train and educate new management accountants by teaching the rules and reasoning that an expert in the field actually uses.	3.21
Management accountants will be familiar with expert systems and how they can be used in the process, control, and use of information.	3.72
Management accountants will be involved in the development of the database (knowledge and domain) of the expert system.	3.79
Expert systems will be used to reduce production bottlenecks.	3.59
Expert systems will be used to minimize the inventory on the factory floor.	3.61
Expert systems will be used to change production schedules when production equipment breaks down.	3.51
Expert systems will be used to change production schedules when materials are in limited supply.	3.52
Expert systems will be used to adjust production schedules to customer orders.	3.61
Estimated percentage by which expert systems will enable factories to cut their inventories.	23.57% ³
Estimated percentage by which expert systems will improve productivity.	20.22% ³
¹ Average of all responses on a 1 (Strongly Disagree) to 5 (Strongly Agree) Likert scale	
² Percentage of respondents that selected 1 (Strongly Disagree) through 5 (Strongly Agree)	
³ Average respondent estimate given in response to an open-ended question	

pected regarding future plans (use or not use expert systems), the surprising result is that there are only two applications where significant differences existed--in response to the statements "Management accountants are familiar with expert systems and how they can be used in the process, control and use information" and "Expert systems are used to change production schedules to customer orders." Inconsistent with the respondents' perceptions for the current use of expert systems, there are no significant differences in the perceptions of future use for: (1) CPA's and non-CPA's and (2) those currently using or not using expert systems.

Comparison of Current and Future Use of Expert Systems

Table 5 shows the comparison of the respondents' perceptions of the current and future use of expert systems. For each application, the respondents' perceptions of the current and future use are significantly different at $p < .01$.

The findings indicate expert systems will be utilized more in the future.

The two applications where the increase between current and future use is the greatest and the perceptions of future use is the greatest are: (1) management accountants are familiar with expert systems and how they can be used in the process, control and use of information; and (2) management accountants are involved in the development of the database (knowledge and domain) of the expert system. Management accountants believe they will be actively involved in the development and use of expert systems. The findings also suggest that companies will be able to significantly ($p < .01$) reduce inventories and improve productivity.

Limitations of the Study

There are four primary limitations of the study. First, the participants (members of the Institute of Management Accountants) in the


Table 5
Comparison of Current and Future Utilization of Expert Systems

Statements to Measure Perception of System	Current Utilization	Future Utilization	Statistically Different at .001 Level
Expert systems are used to train and educate new management accountants by teaching the rules and reasoning that an expert in the field actually uses	2.386	3.213	YES
Management accountants are familiar with expert systems and how they can be used in the process, control, and use of information.	2.295	3.719	YES
Management accountants are involved in the development of the database (knowledge and domain) of the expert system.	2.591	3.787	YES
Expert systems are used to reduce production bottlenecks.	2.523	3.593	YES
Expert systems are used to minimize the inventory on the factory floor.	2.598	3.609	YES
Expert systems are used to change production schedules when production equipment breaks down.	2.460	3.506	YES
Expert systems are used to change production schedules when materials are in limited supply.	2.517	3.517	YES
Expert systems are used to adjust production schedules to customer orders.	2.547	3.609	YES
Measurement Scale: 5 = Strongly Agree; 1 = Strongly Disagree			

study may not be representative of all management accountants. Second, a comparison of plant controllers' responses with systems analysts' responses could not be done because the labels that were provided did not indicate whether the individual was a plant controller or systems analyst. Third, there could be a self-reporting bias since respondents reported their knowledge, interest, and involvement. Based on the findings of the study, this does not appear to be a significant problem. Fourth, since respondents used different interpretations of expert systems, as evidenced by their comments regarding current applications, the mean values for the current use of expert systems may be overstated.

Conclusions

The purpose of this study was to examine management accountants' knowledge, inter-

est, and involvement with expert systems as well as their perceptions regarding the current and future use of expert systems. Plant controllers and systems analysts were surveyed. The findings of this study indicate that plant controllers and systems analysts have limited knowledge and involvement with expert systems. In addition, they are only moderately interested in such systems. While they agree expert systems are not currently used for management applications, they feel that expert systems will be used more in the future to reduce inventories and improve productivity. The results also indicate that management accountants will be involved in the development of these expert systems. 

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